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4 May 1956

CMCC Doc. No. 151X5.98
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Dear Dick:

We are forwarding herewith five copies of Progress Report No. 10, covering the work performed on System No. 3 during the two-month period extending from 4 February 1956 to 4 April 1956.

Sincerely,

Burt

Burt

Enclosures:
CMCC No. 163X5.2,
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Two-Month Progress Report No. 10

System No. 3

Contract No. A-101

4 February 1956 to 4 April 1956

CMCC Document No. 163X5.2

Copy 1 of 7

(This document contains a total of 5 sheets, including this title sheet.)

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1-0. GENERAL. During the period covered by this report, the major effort has been directed toward the completion of the prototype system. Present planning calls for the start of flight tests on 15 May 1956.

2-0. FLIGHT-TEST PLANS.

2-1. Two types of flight tests are planned, namely: evaluation flight tests and operational flight tests.

2-2. The evaluation tests of the prototype system will start on 15 May 1956, and will be conducted aboard a type C-47 aircraft. An operator will be in attendance during these flight tests to make in-flight observations of system performance and to operate a manually-tuned monitoring receiver [redacted] This receiver is not, of course, a part of System 3 but will be included in the evaluation flight-test equipment to provide a check of the signal characteristics monitored and recorded by System 3. 25X1A

2-3. Operational flight tests will start on 5 June 1956. During the operational flight tests, the prototype system will be installed aboard the operational aircraft, and actual operating conditions will be simulated. That is, the system will be unattended during flight and it will be subjected to the same environmental conditions expected during flight operations.

3-0. ANTENNA. The design and construction of the prototype flush-mounted antenna has been completed, and this unit has been installed in the operational aircraft. A pair of commercially available bent-stub antennas will be used for the evaluation tests to be conducted aboard the type C-47 aircraft (one for the System 3 receiver, and one for the [redacted] monitoring receiver). The broad-band characteristics of these antennas have been evaluated and found to be reasonably satisfactory for evaluation test purposes. 25X1A

4-0. PREAMPLIFIER ASSEMBLY.

4-1. Considerable redesign of the preamplifier circuit has been undertaken to improve its stability and to solve a critical heat dissipation problem which is coupled with the problem of mounting the planar-electrode type 6299 tube. A grounded-grid circuit is now used in conjunction with an additional type 6021 tube to compensate for the reduced gain resulting from the use of a grounded-grid stage. This new design enhances considerably the ruggedness and serviceability of the unit.

4-2. The determination of the broad-band circuit element constants was facilitated by the construction and testing of a circuit model designed to operate at one-tenth the frequency actually required. These procedures and the methods indicated above have resulted in a preamplifier structure which is rugged and far more reliable and serviceable than the previous design.

4-3. The printed-circuit board and other hardware required for the prototype have been fabricated. Final construction and testing of this unit will be completed during the next monthly report interval.

5-0. R-F AMPLIFIER ASSEMBLY.

5-1. New etched boards for the r-f amplifier sections have been fabricated and their components mounted in place. Considerable difficulty has been experienced with the electrostatic capacity between etched lines due to the compact construction and high frequencies involved. Specifically, the artificial line which distributes the signal to the various r-f channels is formed by sections of strip transmission lines, and it is particularly difficult to keep the characteristic impedance of the line up to the 180 ohms required, and to maintain a match between the line sections. This problem is being solved by re-routing some etched lines and by the use of board material which has a lower dielectric constant than the board used previously.

5-2. All r-f assemblies have been assembled and tested. All stages have satisfactory gain, but undesirable irregularities still remain in the frequency response of some stages due to the distribution-line deficiencies mentioned above. These residual deficiencies should be corrected within the next few weeks.

6-0. I-F AMPLIFIER ASSEMBLY. The first prototype unit has been completed by the subcontractor. Some minor deficiencies in gain and mechanical construction were found during the initial testing of this unit. Lack of sufficient gain was corrected by a modification of the input circuit. Three additional units, incorporating necessary changes, are scheduled to be completed by 11 May 1956.

7-0. 2ND L-O ASSEMBLY. This assembly has been rebuilt with the following objectives in mind: 1) to improve reliability by eliminating the 1/8-watt deposited-carbon resistors and by changing the second local oscillator circuit slightly, and 2) to compress the circuit to make room for the r-f head gating circuit which has been crowded off the sweep assembly. A new layout has been started, and the new assembly should be completed by 11 May 1956.

8-0. SWEEP ASSEMBLY.

8-1. A modified design of the original sweep assembly has been completed. The modified design differs from the original in several ways. Basically, the modified design involves the use of crystal markers to stabilize the sweep, and the use of a feedback lock-on system which permits a long lock-on period. In addition, the sweep oscillator and reactance tube are now compensated to overcome the effects of supply voltage changes on the oscillator frequency. Various portions of the modified circuit have been tested separately, and the lock-on and timer circuits have been operated satisfactorily under actual input conditions.

8-2. Since the number of components has increased considerably in the redesign of the sweep assembly, it has been necessary to move the r-f head gating circuit to the 2nd L-O assembly, and to encapsulate groups of circuit parts. These parts are potted together in small groups which require less printed-circuit board area than that required before potting.

8-3. Experimentation with various new potting compounds and techniques has resulted in the adoption of a silicone compound which has excellent resistance to the adverse effects of temperature extremes and which retains sufficient resilience so that internal stresses do not damage the encapsulated circuit parts or their interconnections.

8-4. The final layout of the prototype assembly has been started, and the various encapsulated units are in the process of being fabricated. This assembly will be completed by 11 May 1956.

9-0. NOTCH FILTER. A bridged-tee filter has been designed to remove the one-kc component which may be present in the intercepted audio signals recorded on track three of the magnetic tape. This network will be mounted on a small board and attached to the main chassis of the receiver.

10-0. TEST SET.

10-1. A high-frequency test oscillator, which uses a single tube and whose signal output level may be varied between 0.3 and 100,000 microwatts by means of a calibrated attenuator, has been built and tested. A sufficient number of test-signal frequencies will be provided to insure that all channels and oscillator bands in the receiver can be frequency-calibrated and tested for correct operation.

10-2. Experimental work on the circuit which checks the frequency information obtained by the receiver has been completed. Packaging and mechanical design of the prototype test set will be started shortly. (A technical exhibit which more fully describes the test set is being prepared.)

11-0. POWER SUPPLY. The power supply for the prototype receiver has been assembled in position on the main chassis plate, and wired. Tests, using dummy loads, indicate satisfactory operation of this unit.

12-0. JUNCTION BOX. A junction box for the connection and control of primary power and an external time-mark signal applied to the system has been designed and is now being built. Contained in this junction box are circuit breakers for the d-c power, fuses for the 400-cps a-c power, the main power relay, a time-mark signal relay, and five plugs through which the various voltages are distributed.

13-0. SYSTEM 3 MECHANICAL DESIGN AND PACKAGING.

13-1. A wooden mock-up of the receiver has been built and used to check the mounting bracket previously installed in the aircraft. This bracket is attached to a hatch cover which closes the opening through which the receiver is inserted into the fuselage of the aircraft.

13-2. The main chassis plate has been fabricated and the power supply mounted in place. All shield cans have been fabricated, along with a major part of the bracket hardware required for the etched boards. The remainder will be completed as soon as the final layout of all etched boards is completed. As mentioned previously, encapsulated sub-assemblies are also being constructed.

14-0. PLANNING. During the next monthly interval, the major effort will be directed toward achieving the following objectives:

a. completion of tests on r-f heads

b. fabrication of i-f assembly, 2nd L-O assembly, and sweep assembly in the final prototype form

c. layout and construction of test set in final form

d. preparation for evaluation flight tests on or about 15 May 1956, and operational flight tests on or about 5 June 1956

e. preparation of complete detail drawings for fabricated parts and correction of parts lists so that procurement for the production of additional units can be undertaken without delay